

SCIENCE

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CONTRIBUTION TO THE ETIOLOGY OF BERI-BERI.¹

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THROUGH the courtesy of Captain J. R. Durke, of the bark "H. B. Cann," whose crew were prostrated by beri beri in the tropics, two of them dying of the disease, and of Messrs. Edward Hincken & Son, the consignees of the cargo, I have been enabled to extract the following data from the ship's log-book, to which I add some informations otherwise imparted. The bark (registered 1,299 tons) sailed April 27 from Ilo-ilo, Philippine Islands, with a cargo of raw sugar, 70,284 sacks. Let me say that this is a considerable freight, for a sack amounts to 66 pounds, which gives a total amount of over 2,300 tons! The sugar was mostly No. 3, the lowest grade, and the most liable to fermentation.² Fermentation in such a mass of sugar must have set free an enormous quantity of gases. Her crew consisted of fifteen men. On May 22 bad weather set in; there were 18 inches of water in the well in 12 hours, a condition which necessitated pumping every two hours. On June 5, heavy squalls, the bark ships large quantities of water; this weather continues until the 20th. Even when the squally weather has ceased, the pumps are worked every two hours. On July 15 a terrific storm strikes them, and continues until July 20. The decks for 24 hours were continually filled with water. A strong south-west current (60 miles an hour), lasting many days, set in. I observe here that it is generally supposed that there is a connection between the south-west winds and beri-beri. But the current called south-west is the current naturally due to the emptying of the waters of the Indian Ocean into the South Atlantic, around the Cape of Good Hope. It flows, therefore, toward the south-west and not from the south-west. In fact, throughout the voyage the bark never met the south-western trades. The following data show that the bark had less to deal with trade-winds than vessels usually do. When she left Ilo-ilo April 27, the north-east monsoons were becoming very weak; they carried the ship to the Basilan channel. The captain tried to get through Macassar Strait, but the wind was too weak; so he changed his course, and came down, with variable winds, Molucca passage. He was 45 days getting free of the East Indies into the Indian Ocean, through Lombok, an extraordinarily long passage. He had south-east trades, strong and squally, to Port Natal. He had 10 days' hard weather around the Cape of Good Hope, three days of which there was a heavy gale. From the Cape of Good Hope he had variable winds and calms until he struck the south-east trades in the South Atlantic (Aug. 7), which carried the ship past the equatorial line, 3° north latitude. Then he had calms and doldrums to Sept. 11, at which date, latitude 9° 39' north, longitude 44° 21' west, he found south-east winds prevailing instead of the usual north east trades, which he should have met here. These carried him to the North Atlantic and to port. Considering these facts, and the comparatively violent outbreak of beri-beri on the vessel, we must conclude that the etiological importance of the south-west trades in beri-beri has been very much exaggerated, if it is not altogether imaginary. Of course they have clearly an influence, inasmuch as they bring wet and heavy weather, which wet and heavy weather would be, I think, as innocent as the winds themselves if the really toxic action of carbonic emanations was absent.

Bodily exhaustion has always been considered as an etiological factor in beri-beri. Here is added, what, as I just said, is in my opinion, a much more important factor, the influence of carbonic

gases. One month after they left Ilo-ilo, the water got into the hold, and the sugar began to ferment. Strong and stifling fumes permeated the vessel, which continued until she got into still water at Norfolk, Va. On Sept. 3 (this happened—the observation is not without its bearing—in latitude 2° 40' north, longitude 41° 23' west, near St. Helena, 139 days from the Philippines, the 111th day of the fermentation, on the very edge of the range of the trades) Russell, a seaman, was laid up with swollen limbs; he died Sept. 23. The pumping, meanwhile, continued every two hours. On Sept. 16 (latitude 13° 27' north, longitude 52° 14' west) the carpenter was laid up with swollen feet. Sept. 25 Andrew, Sept. 26 Peterson, Sept. 27 Kemp, seamen, were afflicted likewise. The carpenter died Oct. 9. At this date all were more or less ill, except four. The work at the pumps was being continued with fewer hands. A signal of distress was hoisted Oct. 10. There got then 5 inches of water into the well every two hours. Oct. 11 (167th day of the voyage) the tug Rescue came to the relief, took the bark in tow to Hampton Roads, where six men sick of beri-beri were left in the hospital. A new crew was enlisted, and the vessel, having been well pumped out, was towed to New York harbor. It has been said somewhere that there had been a famine on board and a scarcity of water. This, says the captain, has not been the case. They had plenty of water, as appears by the following notation in the log-book: May 20, Filled up starboard water-tank on deck. Aug. 30, Put about 150 gallons of water into the starboard tank. Sept. 16, Saved about 300 gallons of water. Sept. 19, Five feet of fresh water in the tank. And the water was good throughout. Vegetables were the only thing wanting, and rice and ship's bread (hard tack) were plentiful. They had Australian beef, of which they had broached seven casks (a cask is 300 pounds), and one cask of pork (200 pounds). I extract again from the log-book the following insertions to show how far a cask of beef goes: April 27, broached a cask of beef; May 17, beef; May 29, pork; June 8, beef; July 5, beef; Aug. 17, beef; Sept. 14, beef; Oct. 3, beef. It is just a little inferior to American beef. Besides the salt meat, the men had twice a week fresh beef packed in tins, also lime-juice every day, and fresh wheat bread baked every day. The ration table was that required by the English Marine Service.

The crew consisted exclusively of Europeans, the captain himself is a Nova Scotian, and the bark flies the English flag. The disease undoubtedly was beri-beri, so I hear from Surgeon J. C. Perry of the United States Marine Hospital Service, Norfolk, Va. Being English, the patients were placed in charge of Quarantine Medical Officer Dr. W. A. Thom, Jr. All of them have now recovered. One of them, the first mate, reached New York by rail and met the ship at her arrival. There had been eleven men sick; four had resisted, the captain, aged 40; a Londoner, aged 25; the steward, a German, aged 60; and the second mate, an Englishman, aged 35.

I extract from the log-book: Oct. 9, Andrew and Peterson both still laid up, which makes it very hard for the rest of us. It takes all hands to take in top gallant sail, or in fact do almost anything, as we are getting weak from this sickness that has overtaken us. More water than usual coming to the pumps. Mill going almost all the time. Monday, Oct. 10, There are now three men laid up, and we have to-day finished the last of our provisions. The remaining of us are more or less affected by this sickness. It is as much as we can do to pump ship with all hands. Hoisted the signal P.H. to a steamer; apparently he took no notice of us. Five inches of water in the well every two hours. Observe that the victuals gave out only the day before they touched port.

I myself visited the ship and inspected the sleeping apartments of the men. The forecabin is on deck; it has twelve bunks in a room 15 feet long, 10 wide, 7 high; doors and a scuttle give free ventilation. The bunks were tight-boarded pens and, of course, would hold gases.

¹ Communicated to the Sei-I-Kwai, or Society for the Advancement of Medical Science in Japan.

² The fact that the cargo in question came from Ilo-ilo to the United States shows it to be of the lowest grade. The Philippines send us but their meanest wares, strange as that may be, and for some unknown reason always from Ilo-ilo. Nos. 1 and 2 go to Germany and England, always from Manila.

The ship's carpenter, who died, slept by himself in the store-room; his was a closed bunk, like all the others. The first mate slept alone off the mess-room, in the after part of the ship; he contracted the disease.

We have then here the following situation: Toxic matters in the atmosphere, either directly by the fermentation of an enormous mass of sugar¹ and the formation of the poisonous compounds of carbon, or by a decomposition of the air depriving it of part of its oxygen. We have a wet trip, the very weather in which beri-beri, or kakké, flourishes in Japan. We have muscles and peripheral nerves more or less exhausted by the pumping work rendered necessary by the leak.

We have, therefore, an image of the disease, accompanied in the most manifest way by all its etiological factors, which leaves nothing to be desired.

The following facts relating to the export of sugars will perhaps be of some interest. Captain Durke tells me that all sugar cargoes in the voyage blacken the paint;² he says, however, that unless water gets into the cargo the sugar will not really ferment. He has carried many cargoes from the West Indies, the Barbadoes, and all gave off the blackening gas; but he had never a ship ferment before, nor had he ever an outbreak of beri-beri. Therefore the fermentation is not the cause of the formation of that sulphuretted hydrogen. The elder Mr. Hincken, a sugar broker, one of the consignees, says he has many times entered the holds of incoming sugar ships and always found them sweating from the heat in the hold. It must be noted that in the East Indies lime containing sulphur³ is used in the preparation (tempering) of sugar for export to prevent fermentation; hence the blackening gases. In the preparation of the cane-juice for export sugar in the Philippines no molasses is formed. This is the only difference in preparation between it and West Indian sugar; in the latter there is always a formation of molasses. It is the addition of an excess of lime to sugar which prevents the formation of molasses, by the more abundant production of saccharates; hence, if the lime is very sulphurous, we naturally have an excess of sulphuretted hydrogen developed. The sulphuretted hydrogen, if you consider these data, can have nothing to do with the disease; it blackened the walls, that is all. The captain has had walls blackened frequently without beri-beri. One question in passing, Why did beri-beri never occur in any ship exporting sugar from Brazil and the West Indies? The cause may be that the trips of these vessels are comparatively short. Moreover, peculiar care is taken of the Brazilian sugar, for it is known to be a very poisonous stuff; that is, to ferment very easily.

Each of the facts mentioned above; that is, emanations of carbonic compounds, exhaustion, tropical wet weather, may not by itself produce beri-beri. But here we have them united, and their union is strong enough to overcome the resistance of Europeans.

I have elsewhere affirmed my belief in the operation of carbonic compounds in the production of kakké in Japan.⁴ I think that I have a right to consider this case as strongly corroborating my theory. Dr. Takaki, while admitting the action of the carbonic compounds, supposes them to act in a quite different way from that in which they have evidently acted in this case. He believes carbonaceous food to be the cause of the intoxication. Here the effect was produced by inhalation; this is evident by the indisposition of the ship's dog. That animal, as well as the four men who had not contracted beri-beri, was continually vomiting. If the gas operated to make these beri-beri-free men sick, and it was undoubtedly the gas, it was by being inhaled. Now why should the gas not have produced the disease in the others in the same manner; that is, by inhalation? This does away with the theory of beri-beri intoxication through carbonaceous food.

Dr. Takaki claims to have eradicated kakké, which is the same as European beri-beri, from the Japanese Navy, by the elimina-

tion of rice from the diet of the men. That he has eradicated it, I believe. But that it is due entirely to the change in the diet, I do not believe. The men have been at the same time removed from the influence of those fumes of carbon, amidst which the Japanese live and breathe. In Japanese houses charcoal is continually burned for heating and cooking, and the natural humidity of the hot season keeps over everything a deep layer of pernicious gases. In the new navy the men are not exposed to the same influences, their heating being done by steam or coal. The fact that the removal of the beri-beri patients to higher altitudes, where the air is pure, results in improvement is proof positive that the poison is inhaled. This fact, that is, the advantage of altitude, must remind most readers of that unfortunate Neapolitan dog, who inhales the oxide of carbon of the "cave of the dog," for the instruction and amusement of the visitor. The gas, which in this grotto issues from some fissures, is so heavy that it remains in the inferior part of it, and does not reach the nostrils of men; but the dog, breathing in the nether layers, falls down at once in a paroxysm of asphyxia.

It is my opinion, if similar changes in the heating methods to those which were introduced into the navy, were adopted by the people at large the benefit conferred on the navy would become a general, a national one. They have only to stop the burning of charcoal.

That Europeans in Japan rarely contract beri-beri is partly explained by the fact that they are not exposed to charcoal fumes in their houses.

However I do not contend that inhalation of carbonic gases, is the only etiological factor of beri-beri. These factors are necessary: Weakness, produced, on the one hand, by a feeble non-albuminous diet, incapable of maintaining the natural resistance of the body to morbid influences, or by climatic or other like influences,⁵ debilitating the muscular fibres and peripheral nerves, and *the toxic influence itself*, that is, the presence of carbonic gases when it continues for a sufficient time.

ORIGIN OF THE LINES OF MARS.

BY PROFESSOR HENRY W. PARKER.

On examining a copy of Schiaparelli's Map of Mars, May, 1889, I called the attention of the geology class of Iowa College to the striking general coincidence in the direction of the lines with those of coast and mountain trends on the earth, and I referred to the observations on these by Professor Benjamin Peirce, and a suggested explanation by Professor James D. Dana. The coincidence must have occurred to many persons; but I find no reference to it except in a paper by the younger Darwin (G. H. Darwin) read before the Royal Society in 1878, and printed in the "Transactions," to which, as dealing with coast-lines, I was recently referred by Professor Wolcott Gibbs and by S. C. Becker of the U. S. Geological Survey. Mr. Darwin's remarks were founded on a previous and probably much less detailed map of Mars in "Appendice alle Memorie della Societa degli Spettroscopisti Italiani," Vol. VII., 1878. His papers (in Parts 1 and 2 of "Transactions," Vol. 170) relating to terrestrial physics are "On the Bodily Tides of Viscous and Semi-elastic Spheroids, and on the Ocean Tides upon a Yielding Nucleus," and "On the Precession of a Viscous Spheroid, and on the Remote History of the Earth."⁶ In the latter paper, referring to the dragging of tidal protuberance greater at the equatorial regions than at the polar, and the consequent distortion of a yielding globe, he says: "The screwing of the earth's mass [as a viscous spheroid in remote ages, his meaning seems to be] varies inversely as the sixth power of the moon's distance multiplied by the angular velocity

⁵ The temperature in the ship's cabin, during the entire voyage nearly, was over 80°; in the sun, in the Indian Ocean and tropics, it was as high as 126°. In Japan, kakké occurs in the season when the sun is very hot and the air very damp, and the days when these conditions are particularly oppressive, the patients are regularly worse.

⁶ For some pertinent comparisons between the physics of the earth and of Mars, with special reference to the state of internal stress of an elastic sphere under tide-generating forces, but with no mention of the lines of Mars, see Mr. Darwin's paper, "On the Stresses caused in the Interior of the Earth by Weight of Continents and Mountains," in the same "Transactions," Vol. 173.

¹ 10,000 sacks out of 50,000 up to this time unloaded have been involved in the process, and it is expected that about one-third of what remains in the bottom of the bark will be found damaged; that is, about one-fourth of the whole cargo, 500 tons, has suffered.

² The ship's paint was black from sulphuretted hydrogen. I tested some of it.

³ In the icery process, bisulphite of lime is used.

⁴ Univ. Med. Mag., January, 1891. Sei-I-Kwai Med. Journ. XI., No. 2.

of the earth relatively to the moon. And, according to that theory [in the first paper], in very early times the moon was very near the earth, whilst the relative angular velocity was comparatively great. Now, this sort of motion, acting on a mass which is perfectly homogeneous, would raise wrinkles on the surface which would run in directions perpendicular to the axis of greatest pressure. In the case of the earth, the wrinkles would run north and south at the equator, and would bear away to the eastward in northerly and southerly latitudes, so that at the north pole the trend would be north-east, and at the south pole north-west. Also the intensity of the wrinkling force varies as the square of the cosine of the latitude, and is thus greatest at the equator and zero at the poles. Any wrinkle, when once formed, would have a tendency to turn slightly, so as to become more nearly east and west than it was when first made.

"The general configuration of the continents (the large wrinkles) on the earth's surface appears to me remarkable when viewed in connection with these results. There can be little doubt that, on the whole, the highest mountains are equatorial, and that the general trend of the great continents is north and south in those regions. The theoretical directions of coast-line are not so well marked in parts removed from the equator.

"The great line of coast running from north Africa by Spain to Norway has a decidedly north-easterly bearing, and the long Chinese coast exhibits a similar tendency. The same may be observed in the line from Greenland down to the Gulf of Mexico; but here we meet a very unfavorable case in Panama, Mexico, and the long Californian coast-line.

"From the paucity of land in the southern hemisphere, the indications are not so good, nor are they very favorable to these views. The great line of elevation which runs from Borneo through Queensland to New Zealand might perhaps be taken as an example of a north-westerly trend. The Cordilleras run very nearly north and south, but exhibit a clear north-westerly twist in Tierra del Fuego, and there is another slight bend of the same character in Bolivia."

After speaking of his theory as in accordance with the views of geologists, so far as they hold that the general position of continents is what it was from the first, Mr. Darwin remarks:

"An inspection of Professor Schiaparelli's map of Mars (1878), I think, will prove the north and south trend of continents is something [not] peculiar to the earth. In the equatorial regions we there observe a great many very large islands separated by about twenty narrow channels running approximately north and south. The northern hemisphere is not given beyond latitude 40°, but the coast-lines of the southern hemisphere exhibit a strongly marked north-westerly tendency. It must be confessed, however, that the case of Mars is almost too favorable, because we have to suppose, according to the theory, that its distortion is due to the sun, from which the planet must always have been distant. The very short period of the inner satellite shows, however, that the Martian rotation must have been (according to the theory) largely retarded; and where there has been retardation, there must have been internal distortion."

The later map (*Popular Science Monthly*, 1889) after Schiaparelli's observations in 1888, gives the Martian surface from 70° north to 70° south. The number of lines, including those of so-called islands and coasts, running north-easterly, are about equal to those running north-westerly; although, east of 280° longitude the lines are most strikingly north-westerly for about half the surface of the planet, as any one can observe, inverting the map to bring the north to the top, and the west to the left hand (see "Septentrio" and "Occidens" printed in the border of the map).

Beginning with the west, the longest north-west lines (all double) and their angles with the equator are as follows, indicated by names connected with them: Oreus, 20°; Pyriphlegethon, 47° to 50° (both continued on the east in the map); Hydractes-Phlegethon, 24°; and Antæus-Eunastos, 40°, with virtual long continuations extending it from 40° south to 60° north. The mean inclination of these four is about 34°; and a striking fact is that two are 20-24°, and two 40-45° nearly. The mean of ten most noticeable north-west lines, double or single, is about 42° 44'.

The longest north-east lines, also double, are Gigas, the in-

clination changing from 40° on the south of the equator to 30° on the north; Phison, 45°; and Erebus-Cerberus, somewhat curved, 25°; of great length, and continued as a single line east through not less than 150° of longitude. The mean is about 43°, excluding the double Jumana, 75°. Twelve conspicuous north-east lines, single or double, have a mean inclination of nearly 50° 45'. A few others are north and south, or so nearly so as to be counted such.

For comparison, a map of the earth on Mercator's projection must be taken. The mean of ten of the most noticeable north-western trends of coast, mountain, or depression is 60°, as against 42° 44' in Mars. The mean of fourteen north-east is about 46° 25', as against 50° 45' of the twelve above mentioned in Mars,—a striking similarity. The great features, running north and south, are few, as in Mars; viz., the southern Andes, the Ural Mountains; and the less-known chain of eastern Africa.

Mr. G. H. Darwin's theory is, so far as known to the writer, the best one for the earth, and the only one fairly worked out, though, as Mr. Darwin acknowledged, it is poorly consistent with the earth's great north-west lines, and is seemingly opposed to the tidal probabilities of Mars, which has two small but near moons of different revolution. It would be exceedingly interesting if some mathematical astronomer would work out the complicated problem of the tides of Mars (perhaps considerable at conjunctions) on the supposition that its surface was all water. But Mr. Darwin partly dismisses the moons, and refers to the action of the sun, which, however, he thinks must have been inconsiderable. This reference is curiously coincident with a reported suggestion by the late Professor Benjamin Peirce that our continental trends might be due to the "action of the sun." I cannot get from his son, through a friend, any reference to a record of his view; only that in a perhaps unpublished paper, or on some occasion, he called attention, as everyone knows he did, to the remarkable fact that the continental trends are great circles of the sphere tangential to the arctic and antarctic circles,—a fact with some striking illustrations, but not universal. Professor Dana credits the first observation of this to Robert Owen, in his "Key to the Geology of the Globe," 1857.

Professor James D. Dana suggested that the great lines of the earth might be due to a system of cleavage comparable to that of crystals.¹ He refers to parallelism observed in the crystals of a solidifying mass, but does not give particulars. In some crystalline rocks, e. g., gneiss, the parallelism conforms to layers of deposit, and here and in other instances may also have to do with pressure. How it is in respect to unstratified metamorphic rocks is a question to be determined by observation. There is one fact on a limited scale that may have some weight; it is that, in cavities and fissures, implanted crystals have been observed to have uniform alignment to the horizon and points of compass,—similar faces of like crystals flashing simultaneously in the light. The importance of this fact, so far as it holds true, is that the arrangement must depend on some other force than molecular attractions; it may be from a very far-reaching cause, sufficient to produce lines of weakness, here and there, that became concurrent. Perhaps we shall have to fall back provisionally on that fetish of the ignorant and the semi-scientific, "electricity," supposed to explain everything from a tornado to a nervous twinge. In this case it might have a color of possibility, if it be true that

¹ "Cleavage Structure in the Earth's Crust.—The prevalent north-east and north-west courses of trends, the curves in the lines varying the direction from these courses, and the dependence of the outlines and feature-lines of the continents and oceanic lands upon these courses (p. 29) are the profoundest evidence of unity of development in the earth. Such lines of uplift are lines of fracture or lines of weakest cohesion; and, therefore, like the courses of cleavage in crystals, they show by their prevalence some traces of cleavage-structure in the earth,—in other words, a tendency to break in two transverse directions rather than others.

"Such a cleavage-structure would follow from the mode of origin of the earth's crust. The crust has thickened by cooling until now scores of miles through; and very much as ice thickens—by additions to its lower surface. Ice takes a columnar structure, perpendicular to the surface, in the process, so as often to break into columns on slow melting. The earth's crust contains as its principal ingredient one or more kinds of feldspar, all cleavable minerals; and, as crystals on slow solidification often take a parallel position, so it might have been in the cooling crust. This appears the more probable when it is considered with what extreme slowness the thickening of the crust has gone on, and the immeasurable length of time it has occupied."—Dana's "Manual of Geology," 1876. pp. 737-8.

earth-currents have anything to do with such dispositions of matter as the renewed deposit of ores asserted of certain dry mines and tunnels; but no rock-bed, probably, is dry enough to demand such an explanation, which itself requires a great deal of explaining.

In this connection I will add that a hexagonal crystallization in Mars, occurring to the mind of one of your correspondents, is as wild as the canal idea. The radiating lines are on too vast a scale; and there is nothing in any known crystallizations to favor the idea, unless it be the little six-rayed stars of frost spicules, from which the jump to Martian continents is too great. The radiations have their counterpart in the old volcanic surface of the moon and some analogous facts on the earth; also in mountain system "knots," Himalayan or other.

On the whole, the action of lunar and solar tides on planets while in a viscous condition, with more or less crust, is the only hypothesis that so far promises well, in explanation of the remarkable lines of the earth and Mars, notwithstanding the difficulties mentioned.

Yonkers, N.Y., Oct. 27.

RESIDUAL PERSONALITY.

BY ARTHUR E. BOSTWICK, PH.D., MONTCLAIR, N. J.

EVIDENCE is not wanting to show that what we call personality is an extremely complex thing, the sum of subsidiary personalities which now shift and change like the figures in a kaleidoscope, and again, becoming sharply defined under some abnormal condition, crystallize into two or more distinct groups of elements, which alternately sleep and wake or even co-exist. These complex elements may be so unstable, the groups composing them constantly breaking up and forming new combinations, that the idea of multiple personality does not naturally attach itself to them; it is only when they become stable, and especially when each exhibits a well-defined consciousness, that we begin to think of such a thing. But, besides the abnormal and diseased conditions which cause such a separation or crystallization, there are other conditions in which it appears somewhat less distinctly. To one class of these I desire to call attention very briefly — to that embracing what may be called cases of residual personality.

Residual phenomena of all kinds are particularly interesting and instructive, especially those where the few things remaining in a group after many have been removed differ widely in their collective properties from those that have been taken away, while these latter are not in any way distinguishable from those of the sum of both before the division. This is the case often with residual personality. Nothing is more common than for a group of elements in what we call a person to be differentiated in one of various ways, leaving behind a residual group differing altogether in its characteristics, though the differentiated group represents to us, and is indeed considered to be identical with, the original person.

The commonest method of such differentiation is sleep. The elements which sleep, are, as it were, subtracted from the normal personality, but there is usually left behind a very curious something — illogical, credulous, fantastic — whose nightly experiences the whole re-united person recollects in the morning as dreams. The next commonest case is that of the absent-minded person. The major part of the person being absorbed in mental processes of some sort, the residual person lives its own separate mental life, thinks, feels, and wills by itself, and perhaps carries on a train of processes which is continuous with a preceding train carried on under similar circumstances the day before. This residual person may act very mechanically; the re-united person may fail to recollect what its acts or thoughts were and be surprised to find how it has been making use of his limbs while he — what he vainly regards as the one unalterable ego — has been absorbed in thought; but, on the other hand, it may be perfectly conscious, and may carry on an entirely different train of thought of its own. Almost always, however, it is eccentric, and betrays a weakness at one point or another.

For instance, a suburban resident, whom we will call A, is accustomed on landing at the New York side of the ferry to abandon the mechanical task of walking to his office entirely to his

residual personality, and to give up the major part of himself to thought. The two personalities act often with perfect — always with practical — separateness, the residual person being quite equal to the low task of evading vehicles, steering clear of passers-by, and turning the proper corners. When the office is reached and the two persons again become one, it is often a difficult task to remember any circumstances of the walk. On one occasion, however, A left the Astor Library on Lafayette Place, as he supposed, intending to walk down Clinton Place. To do this he must turn first to the left, then to the right, and then again to the left. He turned once to the left, and after some time became dimly conscious that he had walked for a long time, and that the place for the second turn had not been reached. Coming to himself, he found himself far down Broadway. Tracing back his course mentally, he discovered that he had been in the Mercantile Library instead of the Astor; his first turn therefore had taken him down Broadway, and he of course did not reach the place for the second. Mark now the peculiarities of his residual person. It knew just where it was to turn and in what direction, and had sense enough to be uneasy when it did not come to the proper place to turn, but it had not intelligence enough to know that it was on the wrong street. Its mind was too weak to be trusted further than it was accustomed to go. This residual person, in short, was about on a par with a harmless idiot.

Again, B, a New Yorker, is walking along absorbed in a process of thought, when his residual personality sees his friend C approaching. It is not astonished, for he is near C's lodgings, but as the person supposed to be C comes nearer, it sees that he only slightly resembles C; he has on shabby clothes, and his face is entirely different. The natural conclusion would be that the person approaching was not C. The residual person, however, does not argue thus. It concludes at once that C has greatly changed; that he has become poor, and that his appearance has altered for the worse. Pity and surprise are plainly felt by the residual person. During these mental processes, so similar to those of a dream-residual, the major person has kept on with his own train of thought. Finally, however, on the close approach of the supposed C, they unite in a flash into the normal person, the two separate consciousnesses become one, and the truth is recognized at once. No doubt these cases can be paralleled by thousands of others. It seems to me that they are as true instances of double personality as any exhibited by epileptic or hypnotic persons.

Why should the residual person differ so from the normal, while the differentiated person is precisely like the normal? If we take 199 gallons of water from 200, is not the remaining gallon still water? There are many mathematical analogies. In geometry, if we draw a parallel to the base of a triangle we thereby cut off a precisely similar triangle, yet what is left has no resemblance to a triangle. This analogy, carried out, would point to a consideration of personality as a function of position or arrangement of elements, as chemical isomers are functions of the position of their constituent atoms. But an algebraic analogy, which ties us down to no such hypothesis, probably comes nearer the truth. Consider the identical equation $(X + Y) - (aX + bY) = (1 - a)X + (1 - b)Y$. If $a = b$, the ratio of the two terms of minuend, subtrahend, and remainder, each $= \frac{X}{Y}$. But if a and b differ very

little from unity and from each other, then $\frac{a}{b}$ may be sensibly unity, while $\frac{1 - a}{1 - b}$ differs greatly from it, and thus the ratio of

the terms of the subtrahend will be sensibly that of the terms of the minuend, while that of the terms of the remainder may differ greatly from both. In the same way, by extending the number of terms, we may subtract from any polynomial what is sensibly a sub-multiple of it, and yet leave a remainder whose terms bear a very great disproportion. Hence it is, no doubt, that the removal of a group of elements of personality that seems to represent one's normal self may leave a residue so different and so incongruous.

It will be observed that what has been said is entirely independent of any hypothesis as to the nature of the elements of personality and the mode of their combination.

CURRENT NOTES ON ANTHROPOLOGY.—XIX.

[Edited by D. G. Brinton, M.D., LL.D.]

[Dr. Brinton has been appointed, by the President, a commissioner to represent the United States at the Columbian Historical Exhibition in Madrid, and will be absent from the country about two months. One more instalment of these notes will appear before his return.—ED.]

The Congress of Criminal Anthropology.

THE third International Congress of Criminal Anthropology was held in Brussels Aug. 7-13, and resulted in a decided advance in this extremely valuable branch of science. Although Professor Lombroso of Turin, who is looked upon almost as the father of the subject, was absent, and indeed the whole of the Italian contingent—disgruntled, for some reason, it was alleged—stopped away, yet there were very active discussions and a very marked change of base in regard to the physiology of the criminal classes.

Those who have followed the French and Italian writers are aware that they have taken great pains to define the "criminal type." It has been alleged that habitual criminals have a lower average cerebral capacity than others; that their foreheads are retreating, and their brain developed posteriorly; that their lower jaws are strongly pronounced and their ears frequently deformed; their hair thick and coarse, but their beard scanty; and so on. Such was the "criminél né" of the French, the "uomo delinquente" of the Italians. But the Brussels Congress may be said to have upset all this interesting theory. Dr. Tarnowski of St. Petersburg and Dr. Naেকে, from a very wide collation of observations, denied any special physical peculiarity in criminals, either male or female.

The tendency of all the leading speakers was to look upon crime as the result of psychical and social rather than physical peculiarities. It is true that physical abnormalities are more frequent in the criminal class, but there is no constant relation between any one of them and crime. Very many criminals have an inherited tendency to some form of mental alienation; many others owe their character to purely personal and social influences of a deleterious character. Society is far more to blame for their existence than has hitherto been acknowledged; and if the tide of crime is to be stayed, we must have recourse to sounder moral instruction, more judicious systems of legal procedure, and an improved doctrine of punishment. This is the important practical lesson taught by the Brussels Congress.

The next Congress was fixed for 1896, in Geneva.

Shape of Slavic Skulls.

In connection with the article on this subject contributed to *Science*, Oct. 28, by Dr. John Beddoe, I may refer to the measurements of Czech skulls, from villages of pure blood in Bohemia, by Dr. L. Niederle, published in the June issue of the *Mittheil. der Anthropol. Gesell. in Wien*. He found them decidedly brachycephalic, averaging about 85, the skulls of women being more so than those of the males. They were also leptoprosopic, mesorhinc, and hypsicephalic. These peculiarities correspond closely to those noticed in the living population of Bohemia, especially where of pure Slavic blood. Most of the school-children are broad-headed, more markedly so than the adults. They lose in a measure this trait on growing to adult years. The dolichoid form is distinctly more frequent and pronounced in living men than in women, even in the same village and of the same family.

Linguistic Affinities of the Ancient Coptic.

In a memoir prepared for the tenth session of the International Congress of Orientalists, Dr. Carl Abel presents a summary of the evidence which he has been industriously collecting for years to prove the etymological relationship of the language of ancient Egypt with the Indo-European stock. It is an extremely intricate subject, and to many his methods will appear strange, and at first sight repellant. He claims, for instance, that a primitive radical often has two meanings which are the precise opposites of

each other, as "good" and "bad," or "white" and "black." Again, that such a radical was frequently reversed in its sounds, for example, that *rak* and *kar* are the same word, the one being read and originally pronounced backwards, but both are to be construed as the same root. He also presents a series of substitutions in sounds, one organ occasionally taking the place of another in utterance, according to definable laws.

These novelties to old-fashioned students of Aryan and Semitic tongues have not aided to make his views popular; but they have been accepted by such distinguished scholars as Professor Maspero of Paris, Professor Harlez of Brussels, and Professor Sayce of Oxford, as throwing a new and valuable light on the phonetic laws of ancient Coptic. If European scholars would study more diligently the aboriginal tongues of America, they would learn that all these, and various other linguistic processes of which they seem to have very faint comprehension, are part and parcel of the natural development of human speech.

Pre-Columbian Migrations in America.

In the October number of the Proceedings of the Royal Geographical Society, Judge E. F. Im Thurn has an instructive article on British Guiana, giving much fresh information about the economical conditions and gold-diggings there. At its close, he speaks of the native population, and indulges in some speculations as to the origin of the Caribs and Arawacks, who at the time of the discovery inhabited the West Indian archipelago and the northern shores of South America. He maintains that both these nations migrated from the northern continent, following the chain of islands till they reached the southern mainland, where the Caribs located to the east of the mouth of the Orinoco and the Arawacks to the west. The Warraus he believes to have been the antecedent occupants of the region.

As Mr. Im Thurn has written much and well on the Indians of Guiana, I feel called upon to state that there are no facts which justify the theory here advanced, and that every evidence points unequivocally in the opposite direction. Both Caribs and Arawacks unquestionably came from the interior of the South American continent and moved northward, the Arawacks reaching as far as the Bahamas, where Columbus found them, while the Caribs had no permanent villages north of Jamaica. The researches of von den Steinen, Adam, Ehrenreich, and others have settled this beyond reasonable doubt. All the inhabitants of Cuba were Arawacks, but had come from the south. Not a trace of either Carib or Arawack dialects occurs in North America, but they can be found southward to the Rio de la Plata.

Civilization as Influenced by Race.

The perspicuous writer, M. Gustave Le Bon, has an interesting article in the *Revue Scientifique* for October, on the evolution of civilization and the arts as influenced by race. His thesis is that what we call civilization is the expression of certain modes of thought and feeling peculiar to each race; that one race can never thoroughly assimilate the civilization of another; and that the evolution of culture never follows parallel lines in the different races, one developing one element, another diverse elements. This is especially true of arts and religions, these bearing in their evolution little proportion to the remaining momenta of culture. A lower race, he maintains, cannot derive much of real utility to itself from another of considerably higher civilization; and, in general, whatever a race thus borrows, it transforms to suit its own individuality and racial psychology, so that little of the original is left.

These opinions he supports by an examination of the traits of the world religions in different races. Islam in India is no longer monotheistic, but as polytheistic as Brahmanism; so is Christianity among Indo-Germanic peoples; marabouts, saints, virgins, and incarnations of deity are worshipped, not at all the one God of the original Semitic cult. In a similar manner government, institutions, and arts are sure to be transformed by the racial mind, acting unconsciously, and adapted to its peculiarities. He concludes that the effort to force European civilization upon the lower races, unless in a much modified form, is vain and hopeless.

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ORIGIN OF VOLITION IN CHILDHOOD.¹

BY J. MARK BALDWIN.

IN earlier articles of this series² I have endeavored to trace the development of the child's active life up to the rise of volition. The transition from the involuntary class of muscular reactions to which the general word "suggestion" applies, to the performance of actions foreseen and intended occurs, as I have before intimated, through the persistence and repetition of imitative suggestions. The distinction between simple imitation and persistent imitation has already been made and illustrated in an earlier article. Now, in saying that volition—the conscious phenomenon of will—arises historically on the basis of persistent imitation, what I mean is this: that *the child's first exhibition of will is its repeated effort to imitate movements seen and noises heard*.

An adequate analysis of will with reference to the fiat of volition reveals three great factors for which a theory of the origin of this function must provide. These three elements of the voluntary process are desire, deliberation, and effort. Desire is distinguished from impulse by its intellectual quality, i. e., the fact that it always has reference to a presentation or pictured object. Organic impulses may pass into desires, when their objects become conscious. Further, desire implies lack of satisfaction of the impulse on which it rests—a degree of inhibition, thwarting, unfulfilment. Put more generally, these two characteristics of desire are: (1) a pictured object suggesting a satisfaction which it does not give, and (2) an incipient motor reaction which the imaged object stimulates but does not discharge.³

The first clear cases of desire—as thus understood—in the life of the child are seen in the movements of its hands in grasping after objects seen. As soon as there is clear visual presentation of objects we find impulsive muscular reactions directed toward them, at first in an excessively crude fashion, but becoming rapidly refined. These movements are free and uninhibited—simple sensori-motor suggestive reactions. But I find, in experiments with my children, that the vain grasping at distant objects,

which prevailed up to about the sixth month, tended to disappear rapidly in the two subsequent months—just about the time of the rise of imitation. During the eighth month, my child, H., would not grasp at highly-colored objects more than sixteen inches distant, her reaching distance being ten to twelve inches.⁴ This training of impulse is evidently an association of muscular (arm) sensations with visual experiences of distance. The suggested reaction becomes inhibited in a growing degree by a counteracting nervous process; and here are the conditions necessary to the rise of desire. It is safe, therefore, I think, to say, that *desire takes its rise in visual suggestion and develops under its lead*.

The two further requisites to the process of volition are deliberation and effort. The word "deliberation" characterizes the content of consciousness, and may be best described as a state of polyideism, or relatively unreduced plurality of presentations, with a corresponding plurality of motor tendencies (motives). The feeling of effort seems to accompany the passage of consciousness into a monoideistic state after deliberation. It arises just when an end is put to the motor plurality by synthesis or co-ordination. Deliberation may exist without effort, as is seen in deliberative suggestion already described and in pathological *aboulia*, in which a man is a prey to un-coordinated impulses.

Now these further conditions of the rise of will are present first in childhood in persistent imitation, the try-try-again experience. In the pre-imitative period, the so-called efforts of infants are suggestive reflexes. My child, E., strained to lift her head in the second month when any one entered the room; and in her fourth month, after being lifted by the clasping of both her hands around her mother's fingers, the mere sight of fingers extended before her made her grasp at them and attempt to raise herself. Such cases—on which many writers rely, e. g., Preyer—fall easily under sensori-motor suggestion as it borders on physiological habit. The nearest it comes to will is that it may involve faint glimmerings of desire, but it certainly lacks all deliberation. Further, simple imitation, as has already been said, can be readily accounted for without any appeal to deliberation or effort and even without an appeal to desire.

In persistent imitation we have an advance on simple imitation in two ways: (1) A comparison of the first result produced by the child (movement, sound) with the suggesting image or "copy" imitated, i. e., deliberation. This gives rise to the state of dissatisfaction, motor restlessness, which is desire, best described as "will-stimulus;" (2) the outburst of this complex motor condition in a new reaction, accompanied in consciousness by the attainment of a monoideistic state (end) and the feeling of effort. Here, then, in persistent imitation we have, thus briefly put, the necessary elements of the voluntary psychosis for the first time present.

The reason that in imitation the material for will is found is seen to be that here the "circular process" already described maintains itself. In reactions which are not imitative (for example, an ordinary pain-movement reaction) this circular process, whereby the result of the first movement becomes itself a stimulus to the second, etc., is not brought about; or, if it do arise, it consists simply in a repetition of the same motor event fixed by association—as the repetition of the *ma* sound so common with very young infants. Consciousness remains monoideistic. But in imitation the reaction performed comes in by eye or ear as a new and different stimulus; here is the state of motor polyideism necessary for the supervention of the feeling of effort.

From this and other lines of evidence,⁵ we are able to see more clearly the conditions under which effort arises. It seems clear that (1) the muscular sensations arising from a suggestive reaction do not present all the conditions; in young children, just as in habitual adult performances, muscular sensations simply give a repetition of the muscular event. The kinæsthetic centre empties into a lower motor centre in some such way as that described by James (*Psychology*, II., p. 582) along the diagonal line *mc*, *mp* in

¹ The theory of the rise of volition here announced was presented in detail at the International Congress for Experimental Psychology which met in London in August; a full abstract is to be found in the Proceedings of the Congress. The entire paper with further elaboration is to appear in an early issue of *Brain* (London).

² "Suggestion in Infancy," *Science*, Feb. 27, 1891; "Infants' Movements," *Science*, Jan. 8, 1892.

³ Cf. my "Handbook of Psychology," Vol. II., Chap. XIV., § 2, for a fuller development.

⁴ See *Science*, XVI., 1890, p. 247.

⁵ Other evidence is (a) a research on students, called "Persistent Imitation Experiment," and (b) evidence from the pathology of speech; for both of which see the detailed article to appear in *Brain*.

the "motor square" diagram given below (Fig. 1). This is also true when (2) sensations of the "remote" kinæsthetic order (the sight or hearing of movements made) are added to the muscular sensations. They may all coalesce to produce again a repetition of the original reaction. The "remote" and "immediate" sources of motor stimulation reinforce each other. This is seen in a child's satisfied repetition of its own mistakes in speaking and drawing, where it hears and sees its own performances. Con-

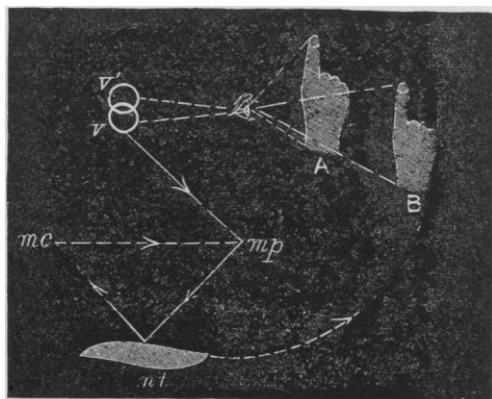


FIG. 1.—Simple Imitation. v, v' = visual seat; mp = motor seat; mt = muscle moved; mc = muscle-sense seat; A = "copy" imitated; B = imitation made. The two processes v and v' coalesce and the reaction is repeated without change or effort.

sequently (3) there is muscular effort only when the "copy" persists and is compared with the result of the first reaction; that is, on the physical side, when the two processes started by the "copy" and the reactive result reach the higher co-ordinating centre together. The stimulus to repeated effort arises from the lack of co-ordination or identity in the different stimulations which reach the centre of co-ordination simultaneously. The mental outcome, effort, accompanies the motor outburst of these combined in-

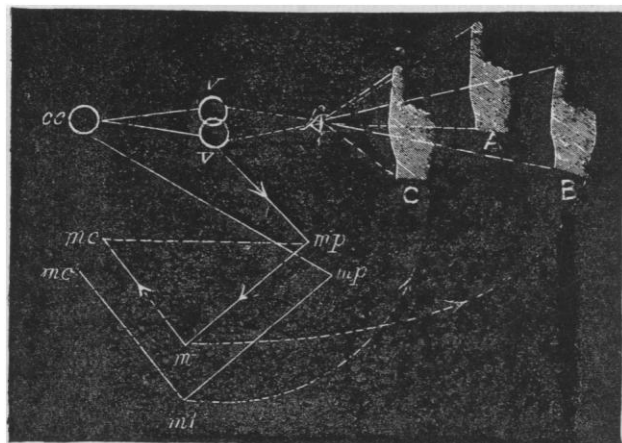


FIG. II.—Persistent Imitation with Effort. C = successful imitation; cc = co-ordinating center. (Other letters same as in Fig. I.) The processes at v and v' do not coalesce but are co-ordinated at cc in a new reaction mp' , mt' , which includes all the elements of the "copy" (A) and more. The useless elements then fall away because they are useless and the successful effort is established.

fluences, and, as soon as this outburst reproduces the "copy," the effort is said to "succeed," the subject is satisfied, "will-stimulus" disappears, and the reaction tends to become simple as habit.

Physiologically the point which distinguishes persistent imitation with effort from simple imitation with repetition is this conflict of processes in the centre. In simple imitation the excitement aroused by the reaction, as its result is reported inwards by

the eye or ear, finds no outlet except that already utilized in the first discharge; hence it passes off in the way of a repetition of this discharge. See Fig. 1.

In persistent imitation the first reaction is not repeated. Hence we must suppose the development, in a new centre, of a function of co-ordination by which the two regions excited respectively by the original suggestion and the reported reaction coalesce in a common more voluminous and intense stimulation of the motor centre. A movement is thus produced which, by reason of its greater mass and diffusion, includes more of the elements of the "copy." This is again reported by eye or ear, giving a "remote" excitement, which is again co-ordinated with the original stimulation and with the after effects of the earlier imitations. The result is yet another motor stimulation, or effort, of still greater mass and diffusion, which includes yet more elements of the "copy." And so on, until simply by its increased mass — by the greater range and variety of the motor elements enervated — the "copy" is completely reproduced. The effort thus succeeds. See Fig. 2.

When muscular effort thus succeeds by the simple fact of increased mass and diffusion of reaction, the useless elements fall away because they have no emphasis. The desired motor elements are reinforced by their agreement with the "copy," by the dwelling of attention upon them, by the pleasure which accompanies success. In short, the law of survival of the fittest by natural, or, in this case, physiological, selection assures the persistence of the reaction thus gained by effort.

This theory of the physical process underlying volition is not open to the objections commonly urged against earlier views. How can we conceive the relation of mind and body? The alternatives heretofore current are three: either the mind interferes with brain processes, or it directs brain processes, or it does nothing — these are the three. Now, on the view here presented, none of these is true. The function of the mind is simply to have a persistent presentation — a suggestion, a "copy." The law of sensori-motor reaction does the rest. The muscles reflect the influence of the central excitement; this creates more excitement, which the muscles again reflect; and so on until, by the law of lavish outlay, which nature so often employs, the requisite muscular combination is secured¹ and persists.

Further, a direct examination of the infant's earliest voluntary movements shows the growth in mass, diffusion, and lack of precision which this theory requires. In writing, the young child uses hand, then hand and arm, then hand, arm, tongue, face, and finally his whole body. In speaking, also, he "mouths" his sounds, screws his tongue and hands, etc. And he only gets his movements reduced to order after they have become by effort massive and diffuse. I find no support whatever, in the children themselves, for the current view of psychologists, i.e., that voluntary combinations are gradually built up by adding muscle to muscle and group to group. This is true only after each of these elements has itself become voluntary. Such a view implies that the infant at this stage knows that he uses his muscles, which is false; knows which muscles he has learned to use, which is also false; and is able to avail himself of muscles which he has not learned to use, which is equally false — not to allude to the fact that it leaves suspended in mid-air the problem as to how the new combination intended gets itself realized in the muscles.

It is evident, also, that in accounting for the earliest voluntary movements as cases of persistent imitative suggestion, we are making the presentation which constitutes the "copy" a thing imported into consciousness, a "suggested" thing which is imposed upon the infant by the necessities of its receptive nature. And so it is. Whether and how the mind ever gets away from this chain of suggestions or "copies," selects its own "copy" or end, and secures by its own choice the persistence of it — this is the question of voluntary attention. Its consideration would lead us too far afield from our present topic, the babies.

¹ This application of the principle of "natural selection" to muscular movement is so simple a solution of this crucial problem that I fear I must have overlooked some suggestion of it in the literature of the subject. At any rate, the tracing of it in the phenomena of imitative suggestion has not occurred elsewhere. As a general hypothesis, however, it is independent of the question as to whether muscular effort is first found in imitation.

THE INTERNATIONAL CONGRESS OF EXPERIMENTAL PSYCHOLOGY, HELD IN LONDON, AUGUST, 1893.

BY ARTHUR MACDONALD, SPECIALIST IN THE U. S. BUREAU OF EDUCATION, AND OFFICIAL DELEGATE TO THE CONGRESS.

ONE of the distinguishing features of the late International Congress for Psychology is the prominent part that physiological investigations assumed. This may be taken as an indication of the prevalent tendency to study the objective rather than the subjective side of consciousness. Yet not a few of the members read papers, which gave the results of an empirical study of subjective reality. The subject of hypnotism and allied states was also one of great interest to all.

Some of the most important questions considered were in the domain of the physiology of the brain, about which comparatively little is known. The statement has often been made that the frontal convolutions are the seat of the intellect as distinguished from the will and desire. This was based upon comparison in the development of this region in man and the lower animals, upon results of accident or disease in man and experiments upon monkeys by Ferrier, Horsley, and Schäfer, and upon dogs by Hitzig and Goltz. For the reason that antiseptic precautions were not taken in either Ferrier's earlier experiments or Goltz's or Hitzig's, it is not certain but that the results obtained may have been due to an extension of the effects of the injury. Professor Schäfer thought it worth while to repeat these experiments upon the prefrontal region by a mode of operation that entirely avoided the shock following from a bilateral removal of a more or less extensive part of the brain. He said that he had often noticed in operating upon the brain that extensive bilateral lesions are liable to be followed by apathy and apparent idiocy, whether the operations were in the frontal or in other regions, more in fact in the temporal than in the frontal region. He thinks it is very probable, therefore, that (1) the question of shock and (2) that of considerable loss of brain substance and removal of support from the rest of the brain (thus impairing the cerebral functions generally) may modify the result. For these reasons Professor Schäfer has recently operated, not by actually removing the portions of the brain, but by severing their connections with the rest of the mantle and with the brain-stem. This can be effected with scarcely any hemorrhage and with no perceptible shock. In several instances in which Professor Schäfer has thus severed the prefrontal lobes in monkeys, there was an entire want of appreciable symptoms. In no case did the animals show the dullness and apathy previously noticed, but they appeared as bright and intelligent after recovering from the effects of the anæsthetic as before the operation. These experiments, therefore, do not support the view that the prefrontal lobes are especially the seat of intelligent attention.

In this connection it will be interesting to note Professor Horsley's demonstration of localization of functions in the monkey's brain, which was given before a number of specialists and psycho-physicists. The monkey was put under the influence of an anæsthetic, and quite a portion of the cranium removed. By electric stimulation Professor Horsley demonstrated clearly the fact of localization; he was able to predict before applying the electrodes what movements would take place, as in the arm, fingers, and face. The experiment was very satisfactory to the witnesses, although Professor Horsley did not think it had succeeded as well as in many former cases when he had performed it before his classes. These now well-known localized areas in the brain of monkeys have been found also by Horsley and Schäfer in the anthropoid ape, which is still nearer man. But the proof has been made complete in a demonstration upon human beings by Professor Horsley. It was in the case of two epileptics in whom an operation was necessary. As far as the operation permitted, it was found that the same localization of function existed in man. It is well to note that the success of experiments upon animals is often due to developed operative skill, as is obtained in surgery. The writer has witnessed many operations of this nature by well-known specialists, but has never seen it so neatly done as by Professor Horsley. Professor Horsley

was also very careful to see that the animal felt no pain throughout the whole operation. One is reminded of Professor Munk's experiments on the dog at Berlin, which attracted great attention at the time. Both Munk and Horsley are surgeons.

It is true that, if one single function is localized, brain localization is established; but this *a priori* method is being made less and less necessary by experimentation. It would seem from these and other investigations that the intellectual function is diffused over the whole brain; this is strengthened by purely psychological considerations from the directing power of the reasoning faculty over the psychical functions in general. It would seem probable that by more exact methods and skilful operations general localized areas will be established throughout the brain, but that these areas can be absolutely defined is quite improbable; first, because they seem gradually to overreach, one area into the other, and, second, the brain is a vicarious organ and the extent of this characteristic will be difficult to determine. But when one thinks of the complexity of the finer anatomy of the brain, not to mention its histo-physiology and chemism, the vastness of the field of investigation is evident; yet these positive results in the coarser anatomy and physiology are an initial starting-point of the highest importance, and may lead in the future to things as yet unthought of.

A recent experiment illustrating kinæsthesia was described by Dr. Ransom; it was a case of epilepsy where the convulsions began by tingling and spasm in the left hand; the following permanent abnormal conditions resulted in this hand: (1) Slight tactile anæsthesia, (2) diminution of muscular sense, (3) diminution of motor power. The operation showed a cyst compressing the cortical centre for the left hand. After recovery from the operation this area was faradized by electrodes inserted through the scalp, without an anæsthetic. From this resulted (1) contraction of groups of muscles in arm and hand by moderate current, (2) production of sensation with a weaker current, contraction added when current was strengthened, (3) improvement of muscular sense during and after stimulation, (4) weakening of voluntary motor power, after a strongly induced contraction.

Dr. H. Donaldson, in his observations on the anatomy of the brain of Laura Bridgman, found the following peculiarities: depression of the motor speech-centre, a slenderness of the first temporal gyrus on both sides and a blunting of both occipital poles with a special disturbance of the fissures in the right cuneus, poor development of temporal lobes, the cranial nerves connected with the defective sense organs were slender, the left optic nerve being the one most affected; the extent of cortex was normal but unduly thin all over; this thinness, however, was most marked in the areas for the defective senses, due in part at least to the smallness of the cortical cells there present. In general, the case represents a maximum peripheral disturbance in the sensory cranial nerves, associated with only such central lesions as followed from lack of exercise and growth.

In his investigations of the muscular sense in the blind, Dr. Goldscheider found a developed sense of touch in the hand and finger joints, and the cause of this was psychical, consisting in a sharpening of the attention and in practice. The sense of location in the skin is small in the blind. In order to recognize forms by touch, the sensation of motion is of greater importance than the sensibility of the skin. Children, whether blind or not, possess a finer sensibility for passive motion than adults.

An interesting paper was that on "A Law of Perception," by Professor Lange of Odessa. The process of every perception consists in a rapid change of a whole series of psychical moments or steps, in which every preceding step presents a less concrete and more general condition, and every following step a more concrete and differentiated psychical condition. There are four principal steps, or stages, in this process of perception: (1) the simple shock, without quality, (2) the consciousness of general modality in the sensibility, (3) consciousness of its specific quality, and (4) consciousness of its spacial form.

The steps, or stages, of our perception correspond to the development of perception in general biological evolution. The so-called muscular reaction consists in a reaction in consciousness upon a simple and undifferentiated shock; the muscular or the in-

nervation effort is not essential to the muscular reaction. The so-called sensorial reaction is not a determinate act, but the reaction upon one of the following steps of perception. The relation between subject and predicate in an act of judgment is a particular case of the law of perception. The consciousness of difference has no ground in the sense of time. The so-called time of choosing shows no element of will.

Mrs. C. L. Franklin, after explaining the difficulties of the Hering or the Young-Helmholtz theories of light sensations, proposed the following new theory: In its earliest stage of development vision consisted of nothing but a sensation of gray (using the word gray to cover the whole series, black—gray—white). This sensation of gray was brought about by the action upon the nerve-ends of a certain chemical substance, set free in the retina under the influence of light. In the development of the visual sense, the molecule to be decomposed became so differentiated as to lose only a part of its exciting substance at once; these chemical constituents of the exciter of the gray sensation can therefore be present separately and cause the sensation of red, green, and blue. A recombination of these substances produces the gray sensation; the mixing of these three colors gives a sensation of no color at all, but only gray. The theory is that of a differentiated color-molecule.

Professor Pierre Janet gave a somewhat extensive description of a disease which he designates as a new form of psychological disaggregation, a mental disease consisting in the weakening of the power of synthesis, which permits during each moment to attach new psychological phenomena to the personality, which are reproduced in the mind. This disease has different forms, according as the incapacity for synthesis affects the sensations, movements, or souvenirs.

Professor Liégeois of Nancy showed it to be quite probable that a woman, who had been condemned to twenty years of hard labor for attempting to poison her husband, was suggestible and hypnotizable to a high degree; that she had received suggestions from a doctor, her lover, to poison her husband in order to be able to marry the doctor; that her moral liberty was greatly diminished if not abolished. Professor Liégeois commended such cases to magistrates, judges, physicians, and juries, so that incompetence and contradictions and excessive severity may be prevented.

Dr. Liébeault and Professor Liégeois described a case of monomaniacal suicide, which was cured by suggestion during hypnotic sleep. It was a woman who had had tendencies to suicide for eleven months.

Dr. Bérillon, editor of the *Revue de l'Hypnotisme*, spoke on the applications of hypnotic suggestion to education. From an experience of attempting hypnotism with some 250 children of both sexes, he deduced these conclusions: In ten children from six to fifteen, of different classes of society, eight could be put into profound sleep after the first or second seance. Contrary to the general opinion, the difficulties of causing profound sleep were greater in proportion as the child presented neuropathic hereditary defects. Healthy children with good antecedents were generally very suggestible, and consequently hypnotizable; they are very sensitive to imitation. While their sleep has the appearance of normal sleep, yet it is easy to obtain amnesia on awaking, negative hallucinations, suggested dreams, and automatic accomplishment of suggested acts. This sensibility to suggestion and hypnotism has been utilized in treating cases which concern pedagogics as much as medicine; such are those with nervous insomnia, nocturnal terrors, somnambulism, kleptomania, onanism, incontinence of urine, inveterate laziness, filthiness, and moral perversity. These facts have been verified by a large number of authors; they belong to practical psychology. Suggestion constitutes a process of investigation which permits us to submit to a rigorous analysis the different intellectual faculties of children, and thus to aid pedagogics by the experimental method.

Mr. F. W. H. Myers, in a paper on "The Experimental Induction of Hallucinations," considers it a drawback to experimental as compared with introspective psychology that we are liable to lose in profundity what we gain in precision; new experiments are required if the operations of the subconscious strata of our in-

telligence are to be reached; such operations tend to be manifested spontaneously in forms of active and passive automatism, such as automatic writing and visual or auditory hallucinations. As to the extent to which these phenomena can be reproduced experimentally, hypnotism is at present the principal means. A form of hallucination which is harmless and easily controlled is "crystal vision," that is, the induction of hallucinatory images by looking steadily into a crystal or other clear depth or at a polished surface. In this way the crystal helps the externalization of those images, sometimes by scattered reflections which suggest *points de repère*; or by partially hypnotizing the gazer. But a crystal vision may sometimes pass insensibly into the summoning up of externalized images, or quasi-percepts, with no definite nidus or background. Such images, or percepts, may depend upon a perceptivity antecedent to sensory specialization and of wider scope.

In speaking of experiments in thought-transference, Mrs. Sidgwick considered the hypnotic state as favorable in such inquiries. By thought-transference is meant the communication of ideas from one person whom we call the agent to another called the percipient, independent of the recognized channels of sense. Mrs. Sidgwick conducted her experiments in conjunction with Professor Sidgwick and others. The successful percipients were seven in number, and were generally hypnotized. It was possible to transfer numbers, mental pictures—that is, mental pictures in the agent's mind—and induced hallucinations given by verbal suggestion to one hypnotic subject and transferred by him to another. There were failures, but the proportion of successes was sufficient to show that the result was not due to chance. One percipient succeeded in experiments with numbers, when separated from the agent by a closed door and at a distance of about seventeen feet. Sometimes the ideas reached the percipient as visual impressions received with closed eyes, sometimes as hallucinations on a card or paper, or by automatic writing, or by table tilting.

It is not known how to produce results at will; only certain persons seem capable of acting as agents or percipients, and these persons succeed at one time and fail another, varying at different times in the same day; the reason for this is as yet unknown.

In the nerve-centres of flying in certain insects, Alfred Binet showed that the dorsal root is motor and the ventral root is sensitive.

Professor Preyer of Berlin read a paper on the origin of number. All concepts can arise through the senses only. No concept (even the concept of number) through heredity alone, without individual sense-impressions, can take place. But the child, like many animals, can value things and numbers without knowledge of numbers; it feels the numbers, not by means of touch or sight, but through hearing. The series of positive whole numbers did not arise originally through addition of 1 to 1; such a hypothesis presupposes a knowledge of a number, namely of 2, and a method of adding. Numbers are acquired in a normal way through hearing and comparison of tones, but later through touch and sight.

As to the effect of natural selection on the development of music, Dr. Wallaschek said that primitive music is not an abstract art, but, taken in connection with dance and pantomime, is bound up with the necessities of primitive tribal life, that is, in war and hunting, for which these dances seem to prepare, and, further, that it helps the tribe to maintain its strength and skill during times of peace. These dances are of a social nature, being performed by the whole tribe with great exactness, due to the influence of rhythm, of which primitive music chiefly consists. This tie of music enables the community to act as one body, holding the community together. Tribes accustomed to *play* at war and hunting associate more easily, act better in case of need, and so are better prepared for life. The musical faculty is thus developed and trained for this purpose.

Dr. Witmer presented a contribution to experimental æsthetic, taking up "the æsthetical value of the mathematical proportions of simple figures." No measurements of the proportions of the human form, as found in nature or in art, nor in beautiful specimens of architecture will demonstrate the æsthetic value of the

mathematical relations of their parts; for we never can be sure that their æsthetic value does not rest upon an associative or other factor rather than upon the direct mathematical proportions; and the freedom in the choice of parts to be measured must throw considerable doubt upon the results of all measurements. Such attempts have proved no more than a limited æsthetic value of the proportion 1:1, while for the various other simple mathematical relations nothing decisive has been shown. A better method than Zeising's or Fechner's affords a choice not limited to a set of arbitrary proportions, but opens to a series of figures whose mathematical proportions vary in a constant ratio between the proportion of 1:1 and 1: x (x being any desired large number). This method permits of an easy observation of the relative increase or decrease in the æsthetic feeling attaching to the regularly increasing proportions. For all groups of figures and for all positions of the figure there are but two pleasing proportions: the ratio 1:1, or perfect symmetry, and a ratio which lies between 2:3 and 1:2, the most pleasing proportion. The proportion 1:1 is æsthetically so far from all other proportions that a comparison between it and any other proportion on the same terms as between the other proportions among themselves is impossible. The most pleasing æsthetic proportion subsumes itself under æsthetic contrast; the æsthetic value does not lie in a pleasing and complex equality of the relations of the parts of a figure, but in a pleasing *difference* of parts. The proportion is therefore not clearly discoverable in complex designs and objects, as the demand for the best contrast of parts may easily give way to other considerations.

Dr. Alexander Bain's paper was entitled "The Respective Spheres and Mutual Helps of Introspection and Psycho-Physical Experiment in Psychology;" the recognized sources of our knowledge of mind are first and foremost *introspection* with the aids of outward signs; to which succeed the study of infancy, of abnormal and exceptional minds, and of the lower animals; also the workings of society collectively; next physiology; and last psycho-physical experiments. The metaphysical problem of knowing and being, and that of the tracing of the origins of our mental furniture, have hitherto been the leading ones where introspection has been mainly employed. Neither of these are utile in the ordinary sense. Introspection takes the lead in qualitative analysis of mental facts; the next consideration is quantitative analysis, or the mensuration of psychological quantities; here psychophysics can render important service. The following is a list of researches where both methods concur: (1) The economy of muscular mechanism; (2) the fundamental laws of the intellect, more especially as regards memory acquisitions; (3) the fluctuation of our ideas in consciousness; (4) the conditions of permanent association as against "cram;" (5) plurality of simultaneous impressions in all the senses; (6) the fixed idea; (7) similarity in diversity. In all these experiment can come in aid of introspection, but cannot supersede it without loss and failure.

Professor Theodore Ribot's paper concerning concepts had for its object an inquiry as to the immediate state of mind at the instant a concept is thought, to determine whether this state differs in individuals. One hundred persons of every class and degree of culture were interrogated by announcing to them abstract terms (not letting them know the purpose beforehand) and noting the immediate state of consciousness which these terms evoked. The results were: 1. With the majority a general term awakened a concrete idea or representation, ordinarily a visual image, rarely a muscular image. 2. Many saw the word as printed, purely and simply, without any concrete representation. 3. Others (fewer in number) had only the word in the mind as heard, perhaps with motor images of articulation but without concrete image; without vision of the printed word. 4. The highest concepts, such as cause, relation, infinite, etc., did not give rise to any representation whatever in the case of the majority. Even those persons belonging to the pure concrete type declared they had nothing in their mind. There are therefore certain concepts to which an *unconscious* state corresponds. Hoping to penetrate into the nature of this unconscious state, Dr. Wizel continued the investigations on certain hysterical cases at Salpêtrière; they were interrogated first in the hypnotic state, then when awake, thus permitting a compari-

son of responses. The results were more numerous and explicit in the hypnotic state than in the normal.

In speaking of the future of psychology, Richet said that psychology is one of the elements of physiology, and the most obscure; the first question is to know the connection which unites mind and body; at present we know nothing about it. An idea, a reasoning, a passion, are phenomena which do not seem to have the power of being reduced to a material phenomenon. It is certain, however, that there is a connection: without brain, or rather without nerve-cell, there is no intelligence. The first problem of psychology is therefore a most complete physiology of the brain: relations of ideation with cerebral circulation, with chemical changes in nerve-cells, with electric phenomena; localization of psychical acts in this or that part of the brain; in other words, a physiological *résumé* of the brain. We must recognize that brain physiology is little developed compared with the physiology of the heart or muscles. Physiology, properly speaking, is a study of sensations: relations of sensation with peripheral excitation, differential perceptive sensibility—the threshold of excitation; these are investigations more difficult to pursue than the general physiology of the nerve-cell.

Comparative psychology treats of the relations of man with other beings, and with the insane and criminal, from the intellectual point of view. One cannot admit that the human soul is stationary; it evolves, and therefore can be perfected through a sort of natural selection. The data for this problem are wanting, yet the future of humanity depends upon it. In transcendental psychology we have numerous data (often or almost always imperfect), which permit us to suppose that human intelligence has extraordinary resources and forces of which we have no conception. The future psychology will give us the key to clairvoyance and presentiments. If it should be proved that these are all illusions, a service would be rendered; sooner or later we will be able to say whether transcendental psychology is a reality or an illusion.

LETTERS TO THE EDITOR.

**.* Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Libyan Alphabet.

I SHALL make no reply to the letter of Professor Keane in *Science*, Nov. 4, as there can be no advantage in discussing scientific questions in either the tone or the method which he adopts.

As the general subject, however, is one of great interest, I have secured permission to bring it before the Oriental Club of Philadelphia at its December meeting, when I expect to prove the following positions:

1. That certain able French scholars maintain that the Libyan alphabet antedates the foundation of Carthage, and probably had other than a Semitic origin.
2. That the first form of every letter, simple and compound, of this alphabet, as given by Hanoteau in his "Grammaire Tamachek," contains no curved lines.
3. That the only similarity noted by Hanoteau in that work between the Tuareg and Semitic writing is that they are both read from right to left.
4. Abundant documents in "Tifinar" to prove that this is not the case will be laid before the club.
5. Proof will also be presented that Prof. Keane's assertion in his last letter that "the Tuaregs never made any extensive use of this script" is utterly erroneous.

An official report will be made to *Science* of this meeting. As the president of the club is Mr. Talcott Williams, not only an excellent Arabic scholar, but the only American who, so far as I know, has collected Berber manuscripts in North Africa and brought to this country the only originals we have, readers of *Science* may expect a fairer statement of the case than in a discussion where personal irritation may be suspected of obscuring scientific fact.

D. G. BRINTON.

Philadelphia, Nov. 4.

Sense of Direction in Animals.

HAVING noticed the recent articles in *Science* on this subject, I wish to add an item that may be to the point

When living near Neosho Falls, Kansas, a neighbor, who was a market bird-hunter, went from there to western Missouri for the purpose of hunting quails and prairie-chickens in the fall of the year. He took with him a favorite pointer dog. The route taken was southward some fifty miles to Parsons, Kansas, by railroad thence north-eastward to Fort Scott, and on into Missouri nearly due east from the latter point. All went very well for a few days after he began hunting, but by some means the dog became lost from him. He spent two days hunting it, and as it was no use to try to hunt without the dog he went home, and there found the dog all right. According to the report of his family, the dog had reached there within two days from the time he lost him, and, as the distance was more than 75 miles, it is quite certain that the dog took a near cut for home. Now if this dog had no sense of direction, what had he that led him to take what we may confidently believe to be the straight and true course for home when he had passed over the other two sides of the triangle by rail?

Who does not know that a cat, or even a half-grown kitten, taken a long way from home in a bag nearly always finds its way back? When living in northern Michigan I had a cat we were tired of. I took her in a boat directly across the lake about two miles and turned her loose. Although it was about six miles around the end of the lake, a circuitous course, and certainly one unknown to her by sight, the next morning she was back at the old place. Another case is just stated to me of a cat that was taken by rail fully twenty miles in south-west Missouri, and the next day he walked in all right at his former home.

H. E. VAN DEMAN.

Washington, D.C.

A Lamentable Case.

PERHAPS another case like the one here recorded will never appear in your columns. At least we may hope so. The person referred to, and whose name will not be mentioned, from the respect in which I held him, was a true lover of nature and an observer. I first knew him, over a score of years since, when to my boyish view he presented the prime features of a country naturalist's existence. He was a poor man and not well educated, but he was a lover of my pursuits, and he read excellent books.

Long years after, and upon returning from a residence in another quarter, I inquired about my nature-loving friend, and found that he was cared for at the County House. I went to call upon him and found that he was dead. One line in the poor-house register was all I could find concerning the blameless man, for the present proprietor came after he was gone and knew nothing of him. There it was: ———, aged — years, died ———.

In my fancy I compared him to Thoreau, and he undoubtedly had similar thoughts and feelings.

How lov'd, how honour'd once, avails thee not,
To whom related, or by whom begot;
A heap of dust alone remains of thee;
'Tis all thou art, and all the proud shall be!

M. G.

Flight of Archippus.

ON the morning of October 22, between eight and nine o'clock, I witnessed the largest flight of *Danaïs archippus* I have ever seen, and the only one I have observed in Texas. The morning was cloudy with little or no breeze. The direction of the flight was southward. The butterflies were not in such close masses as I have seen them previously, and were flying at various elevations from twenty feet to as great a height as the eye could reach. I counted one hundred passing a given line in less than one minute. After watching them for some time I drove across the line of flight a quarter, or perhaps one-third, of a mile and then northward with the line of flight for more than a mile. Over the whole distance the butterflies were fully as numerous as when I first saw them.

E. T. DUMBLE.

Austin, Tex., Nov. 1.

Coddling-Moth Statistics from Oregon.

THE following points have been determined here this season, and may be of interest to the entomological readers of *Science*. Average life of moth, 10-15 days; egg-laying taking place during the latter part of that time. Time required for incubation, 4-10 days; length of life of larva in apple, 4 weeks (about); time passed in cocoon before emergence of moth, 23 days.

This tallies very closely with Riley's observations made a number of years ago in the East; but he makes the life in the cocoon considerably longer.

The first moths were observed here May 16, and the last egg noted, apparently fresh, on a pear September 19. The moth is at least four-brooded in Oregon.

F. L. WASHBURN.

State Experiment Station, Corvallis, Ore., Oct. 25.

Action of Electric-Light on Plants.

IN various reports of the effects of electric-light upon the growth of plants I have noticed nothing upon the, to me, interesting question of whether the effect of electric-light is to keep open at night flowers like the lily and evening primrose, which ordinarily close at departure of daylight. If this point has been discussed, can you kindly give me reference to such discussion?

C. H. AMES.

Boston, Mass., Nov. 8.

Chemical Nomenclature.

WOULD you kindly correct an error which inadvertently crept into my article on the "Spelling and Pronunciation of Chemical Terms" in the current issue? On page 273, column 1, line 16 from the top, instead of "by an American chemist" read "from a North American mineral."

T. H. NORTON.

Cincinnati, Nov. 12.

The Humming-Bird's Food.

DOCTOR MORRIS GIBBS's article recalls an observation which suggests that the humming-bird may find, in spring, an important supply of food in the sap of certain trees — particularly before flowers are abundant. In the case observed it was taking the sap of *Quercus rubra*. Other trees would furnish a more agreeable repast, doubtless.

H. L. BRUNER.

BOOK-REVIEWS.

Manners and Monuments of Prehistoric Peoples. By the MARQUIS DE NADAILLAC. Translated by NANCY BELL. Illustrated. 412 p. New York, G. P. Putnam's Sons. \$3.

The author of this work is already favorably known in this country by his excellent "Prehistoric America," and in France he ranks among the most active and respected of the students of prehistory. In this volume he endeavors to present a faithful and vivid portraiture of the life of man during the Stone Age, especially in Europe, though by no means confined to that continent. He does not undertake to assign a definite length to this phase of civilization, recognizing that it is not so much a period of duration as a stage in culture. He concedes, however, that it was in ancient Europe of great length, "countless centuries."

During the greater part of it man depended upon hunting, fishing, and the natural products. But even then his arts had begun. He made weapons and tools, he used clothing, pleased himself with ornaments, was acquainted with fire, dug canoes from trees, and at times produced creditable artistic sculptures and drawings. The origin and growth of these arts are illustrated by numerous examples drawn from a surprisingly wide familiarity with the literature of the branch.

An interesting chapter is devoted to the kitchen-middens, caves, pile-dwellings, and stone buildings, which served to protect the ancient natives. He describes the megalithic monuments, such as the dolmens, menhirs, and cromlechs, which have excited so much discussion, but declines to assign them to any known people. Yet if, as he intimates, many of those in France were constructed during the Bronze Age, it is difficult to avoid the conclusion that they were by the peoples whom Cæsar mentions as living there at the time of his conquest of Gaul.

The industry, commerce, and social organization of men in the Stone Age are inferred from a variety of evidence, and form the subject of an interesting chapter. The care which they evidently took of the wounded reflects favorably both on their kindness and skill. A chapter on fortifications concludes with an excellent summary of Dr. Schliemann's investigations on the site of ancient Troy.

In handling such a mass of material a few errors naturally creep in. It is not correct to say (p. 21) that "the mounds of North America contain none but copper implements and ornaments," as ornaments of gold, silver, and meteoric iron are not unfrequent. So (on p. 76) the writer says that the ancient canoes "must have been worked by means of oars," and seems surprised too at the absence of rowlocks. Of course, paddles, not oars, were the means of propulsion. It is difficult to perceive what he means by this extraordinary passage on p. 219 — "The most ancient settlements of Malabar contain iron tridents, and Genesius (*sic*) dates their use from before the deluge. It is, therefore, surprising to find that some races remained for an illimitable time ignorant of the way to procure a metal of such great utility." This sounds like eighteenth century science. But these are slight blemishes on a book of singular merit in its composition and unusually beautifully printed and illustrated.

Alaskana, or Alaska in Descriptive and Legendary Poems. By BUSHROD W. JAMES. 368 p. Illustrated. Philadelphia, Porter & Coates.

IF Professor James had not had the unfortunate idea that he is a poet, he would have written a book of considerable interest, as he has visited various localities in Alaska and has read several works about that country. As it is, he gives us 360 solid pages of verses in the meter of "Hiawatha," with "some slight improvements," as the announcement of the publishers modestly puts it, describing the natives, the scenery, the seals, the sunsets, and the stories, which he has by the above means found out about.

It would be unfair not to supply a sample of his poetry, which we select at random from his canto or fyttte on the Alaskan native tribes:—

The Orarians take precedence,
Classed as Esquimaux or Innuits,
Dark Creoles, and sturdy Aleuts —
These hold close along the sea-board,
Claiming nearly all the coast-line
And the islands near adjoining; —
Save where here and there the Indians
Have and hold small coast possessions
Which they won by force or cunning.

Really, was it worth while to put capital letters at the head of these lines? And are there people who will read 360 pages of such? If so, human nature has certain qualities of patience or kindness for which we did not give it sufficient credit.

There are a number of photogravures in the volume, very nicely done, and, as far as type and paper go, it is a creditable specimen of the publisher's taste, and looks as if it was intended to be a "Holiday book."

Experiments Arranged for Students in General Chemistry. By EDGAR F. SMITH and HARRY F. KELLAR. Philadelphia, T. Blakiston, Son & Co. 8°. 57 p., with alternate leaves blank for notes.

THIS series of exercises, based on the authors' experience with their own classes, is intended to accompany any convenient textbook of inorganic chemistry; but reference is made to that of Richter. Beginning with fundamental operations (as with blow-pipe, glass tubing, balance, and graduates) and general principles (as the difference between chemical and physical change) the course proceeds to the study of hydrogen and other non-metals in Part I., followed by the metals in Part II. Quantitative relations are well presented in the experimental work and stoichiometrical

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Nov. 12.—J. P. Iddings, Geology of the Crazy Mountains; H. W. Turner, Lavas of Mount Ingalls; W. H. Dall, Dates of Publication of Conrad's Monographs of Tertiary Fossils.

Anthropological Society, Washington.

Nov. 15.—Warren K. Moorehead, Xenia, O., Singular Copper Objects from Ancient Mounds in Ohio; James Mooney, Lester F. Ward, W. H. Holmes, W. Hallet Phillips, W. H. Babcock, and Frank Baker, Geographic Nomenclature of the District and Vicinity, a Symposium.

Society of Natural History, Boston.

Nov. 16.—Warren Upham, The Origin of Drumlins; Professors Shaler and Davis, On the Origin of Drumlins.

THE Civil Service Commission will hold examinations on Nov. 29 to fill two vacancies in the Quartermaster-General's Office, one in the position of assistant civil engineer, at a salary of \$1,200, the other in the position of architectural draftsman, at a salary of \$1,400. An application blank and information as to the subjects of the examination may be obtained of the U. S. Civil Service Commission, Washington, D.C.

Reading Matter Notices.

Ripans Tabules cure hives.

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Exchanges

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For exchange.—Fine specimens of Wis. freshwater pearls. I want books or papers on marine and freshwater algae; also classified specimens of same. I will exchange for Smithsonian reports or crystallized minerals. D. M. ANDREWS, Dodge Centre, Minn.

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For Exchange.—"The Birds of Kansas."—Goss, for Gray's Anatomy, or Medical Dictionary. Must be in good condition. Address, J. H. SIMPSON, Buchtel College, Akron, Ohio.

For Sale or Exchange.—The subscriber would like to receive cash offers, or an offer in exchange for the earlier volumes of Poggendorf's Annalen and the later volumes of Silliman's Journal, upon the following list: Chenn—Manuel de Conchyliologie. 2 vols. Nearly 5,000 figures, some hand-colored. Paper. Paris, 1859. Edwards.—Butterflies of N. A. 2 vols. Plates hand-colored. Vol. I., half calf. Vol. II. in parts. Leyman, Agassiz, Hagen.—Ils. Cat. Mus. Comp. Zool. at Harvard. No. I. Ophiuridae. No. II., Acalephae. No. III., Astacidae. All bound in one volume. American Naturalist. Vols. I.-VII. Cloth. Silliman's Am. Jour. of Science and Arts. Third Series. Vols. I.-X. Cloth. Binney.—Terrestrial Mollusks of N. A. Colored plates. 4 vols. Stretch.—Zygaenidae and Bombycidae of N. A. Colored plates. Also a considerable library of monographs, reports, and scientific books, and a large number of duplicates of fossils, minerals and shells. E. A. STRONG, Ypsilanti, Mich., Sept., 1892.

Wants.

A POSITION is desired in the South, preferably the Gulf States, where I can teach the sciences. Can also instruct in other branches. Salary only nominal, as I am simply desirous of employment while spending the winter in the South. A private family preferred, but will accept regular school work if not too confining. MORRIS GIBBS, M.D., Kalamazoo, Mich.

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CHEMIST AND ENGINEER, graduate German Polytechnic, Organic and Analytical, desires a position in laboratory or chemical works. Address 213½ E. 7th Street, New York, care Levy.

The American Geologist for 1893.

Edited by PROF. S. CALVIN, University of Iowa; DR. E. W. CLAYPOLE, Buchtel College; JOHN EYERMAN, Lafayette College; DR. PERSIFOR FRAZER, Penn. Hort. Soc.; PROF. F. W. CRAGIN, Colorado College; PROF. ROBT. T. HILL, U. S. Irrigation Survey; DR. ANDREW C. LAWSON, University of California; FRANK D. KNOWLTON, U. S. National Museum; JOSEPH B. TYRRELL, Geol. Sur. of Canada; E. O. ULRICH, Minnesota Geological Survey; PROF. I. C. WHITE, University of West Virginia; PROF. N. H. WINCHELL, University of Minnesota. Now in its Xth volume. \$3.50 per year. Sample copies, 20 cents. Address

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problems, as in determining the *H*-equivalent of zinc, the density of *Cl*, eudiometric combustion of methans, etc.

Methods of Gas Analysis. By DR. WALTHER HEMPEL. Macmillan & Co. 399 p. \$1.90.

THIS standard work was translated by Professor L. M. Dennis with the personal co-operation of the author. Part I. discusses general methods, including the collection of samples, the use of gas burettes and pipettes, purification of mercury, and absorption apparatus; Part II. deals with special methods for the several elementary and compound gases; while Part III. presents the practical applications of furnace gases, illuminating gas, the sulphuric acid industry, the atmosphere, elementary analysis, and the heating power of fuel. The reputation of the author is guarantee for the value of this new volume to chemists interested in his lines of work.

AMONG THE PUBLISHERS.

A NEW edition of the "New Elementary Algebra," by Charles Davies, LL.D., edited by Professor Van Amringe of Columbia College, has been issued by the American Book Co. This work, it seems unnecessary to say, so well known is it, is designed to supply a connecting-link between arithmetic and algebra, to indicate the unity of the methods, and to conduct the pupil from the arithmetical processes to the more abstract methods of analysis by simple and easy gradations, and to serve as an introduction to more advanced works on the subject. The present edition has incorporated in it such emendations as the progress of educational science has suggested.

—The American Book Company have just published the "Standard Arithmetic," embracing a complete course for schools and academies, by William J. Milne, Ph.D., LL.D., president of the New York State Normal College at Albany. Recognizing the fact that, aside from the general knowledge of arithmetic

necessary to all intelligent persons, there are special applications of this branch of mathematics that call for special training on the part of the student, the author has prepared this work with a view to meeting such requirements. Provision is made to furnish ample practice, for instance, for the student who desires merely to become a rapid and accurate accountant, as well as for the one who prefers the training which cultivates the reasoning powers at the expense of practical expertness in the use of numbers. The scope of the work is sufficiently comprehensive to meet the demands of even the most advanced school.

—"Nature Study for the Common Schools" is the title of a neat volume of about 450 pages from the press of Henry Holt & Co. It is the work of Wilbur S. Jackman, A.B., teacher of natural science in the Cook County Normal School, Chicago, and is intended to be a guide for teachers in the common schools, who wish their pupils to pursue an adequate and symmetrical course in natural science. The plan adopted is based upon what the author believes to be the proper interpretation of the character of the knowledge that the average child may be readily induced to acquire. Instead of endeavoring to give the pupil a thorough knowledge of a few animals and plants, an effort is made to give him some knowledge of everything with which he comes into contact; this knowledge, of course, once acquired to serve both as foundation for and incentive to further acquisitions in the same general direction. The volume, it may be well to add, is written for the teacher, not for the pupil.

—At the October meeting of the Agassiz Club at Corvallis, Oregon, a society recently formed for the discussion of scientific subjects, Professor H. T. French exhibited some clover growing in a root-cage, and showing nitrogen nodules on the roots; Professor Craig, some alfalfa infected with dodder, and Professor Washburn, a new insect-breeding cage. The paper of the evening was by Mr. Thomas Jeffreys, and was entitled "What constitutes American citizenship?"

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RACES AND PEOPLES.

By DANIEL G. BRINTON, M.D.

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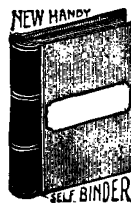
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